M O U T H B R E A T H I N G .

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C R E W E .

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M O U T H B R E A T H I N G .

During several years experience in the medical inspection of school children I have frequently been struck by the large numbers who regularly breathe through the mouth instead of in the normal manner through the nose. Once my interest in this practice was aroused it became quite evident that it was by no means confined to children but was very prevalent amongst adults also.

Mouth breathing is one of the commonest defects found amongst children, but it has not hitherto received the attention it merits. This is largely owing to the fact that it has been considered merely as one of the symptoms of "Adenoids". At the time I first directed my attention to mouth breathing I believed, as was taught in the text-books, that it was, at least generally, due to adenoids. My work

in the Infant Welfare Centres and in the schools has caused me to alter my opinion. I found that many mouth breathing children showed no evidence of adenoids whatever, and were able to breathe with perfect freedom through the nose when asked to do so.

With a view to discovering what was the actual prevalence of this habit, and what, if any, was its relationship to adenoids, I have recently paid special attention to this subject, and the results obtained are stated in the following tables. I may say here that the results have rather confirmed my belief that mouth breathing is not the result of adenoids, but is instead one of the most important predisposing factors in the causation of adenoids.

Before proceeding further it may be desirable to state what I believe to be the sequence of events leading from mouth breathing to adenoids.

The normal function of the nose is to warm, moisten, and cleanse, the inspired air before it enters the lungs. Its most important function, from our present point of view, is to intercept and destroy any pathogenic organisms which may be present in the air: its blood supply is therefore copious and

active. When mouth breathing becomes established these functions of the nose are no longer utilised, and, like every other disused organ, the nose degenerates; its blood supply becomes less active and reduced in volume, its mucous membrane loses its tone, and, what is of the greatest importance, its resistance to the attack of micro-organisms becomes greatly reduced. It is obvious that in these circumstances the nose and its sinuses become congenial homes for bacteria; where warmth, moisture, and food in the shape of the nasal secretions, are to be found in abundance. The ground is now prepared for the second element which actually causes the adenoids to form; this is nasal infection. Mouth breathing children, owing to their lowered resistance, readily catch cold, and they are apt to recover incompletely: they are apt to suffer from chronic nasal catarrh. This catarrhal inflammation spreading backwards to the naso-pharynx affects the lymphoid tissue in the vault, causing it to enlarge, at first temporarily but later, as the result of repeated or prolonged infection, permanently. Adenoids have now become established. Mouth breathing alone will not produce adenoids. It is important not

to lose sight of the part played by the nasal sinuses, as well as by the adenoids themselves, in forming foci where infection lingers, and from which re-infection repeatedly takes place.

Amongst school children all stages of progress as outlined above can readily be found.

P A R T II .

Results of the Inquiry.

Origin of Mouth Breathing.

During the first two months of infancy the great majority of babies breathe entirely through the nose. Occasionally, it is true, we meet with infants who are said to have had adenoids from birth. I have only met with one such case where the adenoids were removed during the first week of life, and where the child was still so young that the eary history could be considered quite reliable: in this case the history showed that a severe cold preceded the adenoids.

During and after the third month open mouths

begin to greet one. These occur not only in artificially fed infants but also in perfectly normal, healthy, breast fed babes. In these normal babies I am satisfied that the open mouth is due to the infant's habit of putting everything it can grasp into its mouth, and the mouth is kept open in the readiness of anticipation. Mouth breathing in such cases is, as a rule, only temporary and occasional.

At later ages we begin to find cases of mouth breathing due to abnormal causes making their appearance. The two commonest causes are "colds", and the dummy teat or comforter. Many mouth breathing babies have histories of repeated colds, and in such cases I usually find that one or other of the parents suffers similarly or has some form of chronic nasal disease. The infant is therefore repeatedly or constantly exposed to infection. The indifference with which nasal catarrh is regarded by the lower ranks of society is amazing. Many of them seem to accept it quite as a normal state of affairs, and make not the slightest attempt to have it remedied. Catarrh, owing to the obstruction it causes, produces temporary mouth breathing, and this has a tendency to

persist even after the catarrh has disappeared; while when the catarrh recurs frequently or is prolonged the habit of mouth breathing will inevitably be acquired.

The part played by the comforter in producing mouth breathing is due to the constantly open mouth its use entails. Babies can frequently be seen with the dummy held loosely between their open lips sound asleep or engrossed with something which has caught their attention.

Mouth breathing due to mechanical obstruction of the nasal passages forms but a small percentage of the total cases: a more important cause is imitation, particularly in the older children.

In some children I have been unable to find any cause for the mouth breathing; a fact which is not surprising when we remember the large numbers of mothers who have "never noticed" how their children breathe.

It will be seen that the commonest causes of mouth breathing are nasal infections and the dummy. It might be thought that these act by causing adenoids: I am satisfied that in infants at least this is not the case, for in the great majority of instances I have

failed to find any evidence which would justify a diagnosis of adenoids.

Prevalence of Mouth Breathing.

One great difficulty in such an inquiry as this is to obtain accurate figures. Information from the parents is, I have found, misleading and worthless: moreover, many of the older children are quite well aware that they ought to breathe through their noses, and, on coming before the doctor, keep their mouths firmly, frequently painfully, closed. The "mouth breathers" in the following tables are all definite mouth breathers, but the "nose breathers" contain a certain number of mouth breathers. This, I fear, is unavoidable, but it has the effect of lowering the percentages of mouth breathers, and of lowering the average heights, weights, etc., of the true nose breathers. The disparity between the two classes is therefore greater than is shown in the following tables.

Tables I and II give the results obtained in the examination of school children in Barrow-in-Furness and in Crewe during the years 1920 and 1922. Of the 1,736 Barrow children 27.6% were mouth breathers,

while of the Crewe children36.8% were similarly affected. The higher percentage of mouth breathers in Crewe can be attributed, I believe, to the fact that Crewe is built on a heavy clay soil, and is, in consequence, cold and damp. A further contributary factor is that the majority of Crewe houses are damp, owing to insufficient damp proof courses. Catarrhal diseases are therefore very prevalent in Crewe. Barrow is superior to Crewe in so far as the water carriage system of refuse disposal is universal there, while in Crewe conservancy methods predominate. On the other hand, employment in a railway town such as Crewe is much more regular and steady than in Barrow.

Speaking generally, the environment of the children is superior in Barrow, while the social conditions are better in Crewe.

The numbers given in the following tables under the heading "Tonsils and Adenoids" are the numbers of children requiring operative treatment, or to be kept under observation,for the condition generally known by that name.

Table I.

1,736 Barrow-in-Furness Children.

Age Group.	Number Examined.	Mouth Breathers. Number.	%	Tonsils and Adenoids. Number.	%
Entrants. (ages 3-6)					
Boys	334	118	35.6	22	6.6
Girls	316	82	26	34	10.7
Total	650	200	30.8	56	8.6
8 year old.					
Boys	196	63	32.1	8	4
Girls	208	56	27	11	5.3
Total	404	119	29.4	19	4.7
9 year old.					
Boys	109	33	30.3	10	9.1
Girls	86	26	30.2	11	12.8
Total	195	59	30.2	21	10.8
Leavers. (ages 12-14)					
Boys	244	65	26.6	18	7.4
Girls	223	37	16.1	14	6.3
Total	467	102	21.8	32	6.9

Table II.

1,238 Crewe children.

Age Group.	Number Examined.	Mouth Breathers. Number.	%	Tonsils and Adenoids. Number.	%
Entrants.					
Boys	193	97	50.3	20	10.3
Girls	144	54	37.5	8	5.5
Total	337	151	44.8	28	8.3
8 year old.					
Boys	142	79	55.6	18	12.7
Girls	152	53	34.8	15	9.8
Total	294	132	44.9	33	11.2
Leavers.					
Boys	301	122	40.5	21	6.9
Girls	306	50	16.3	20	6.5
Total	607	172	28.3	41	6.7

These two tables bring out three points of interest:-

1. Mouth breathing is decidedly more prevalent amongst the Entrants and the 8 year olds than it is amongst the Leavers.

2. Girls at each age period are less addicted to the habit than are boys.

3. Yet amongst the girls enlarged tonsils and adenoids are practically as common as, frequently more common than, they are amongst the boys.

The conclusions drawn from these two tables are stated in Part III.

Effects of Mouth Breathing.

With a view to ascertaining what differences there might be between mouth breathers and nose breathers in bodily and mental growth, the children of the ages 12 and 13 were selected for comparison. It was thought that the results would be more reliable in their case than if younger children were chosen. I have found, however, that such comparison applied to the younger ages shows similar results to those shown in the tables.

Table III gives the result of a comparison of the average heights, weights, and nutrition figures, of the children in these age groups. The Nutrition Figure is the number of grammes of weight per centimeter of height, and is therefore a means of comparing the relative nutrition of the two groups.

Table III.

Heights and Weights.

	Number Examined.	Height in Centimeters.	Weight in Kilograms.	Nutrition Figure.
Boys.				
Age 12.				
Nose Breathers.	89	139	32.7	235.3
Mouth Breathers.	54	138.6	32.6	235.2
Age 13.				
Nose Breathers.	79	143.7	35.7	248.4
Mouth Breathers.	55	142.4	34.5	242.3
Girls.				
Age 12.				
Nose Breathers.	119	140.9	33.3	235.6
Mouth Breathers.	29	138.4	31.2	225.4
Age 13.				
Nose Breathers.	80	146.2	37	253.1
Mouth Breathers.	13	144.6	35.8	247.5

This table shows that on an average mouth breathing children are below the others in height, weight, and general nutrition. It will be noticed that in the case of the 12 year old boys the difference between the two groups is very little; a result which does not conform to the general rule. On examiming the records again, I found that this unusual result

was due to the inclusion of the results obtained in one school. At this school 28 boys were examined, of whom 19 were nose breathers and 9 mouth breathers; but while the mouth breathers were of the average height and weight of their class, the nose breathers were all of poor physique, and three were exceptionally small and puny. The following table shows the effect of omitting these 28 boys.

Table IV.

Nose Breathers	70	139.6	33.1	237.1
Mouth Breathers	45	138.6	32.6	235.2

The differences between the two groups, though still small, is more comparable with the figures of the other groups.

Effect on Mental Progress.

Turning now to mental progress as measured by the Standard in which the children are graded, we find that the mouth breathing children again compare unfavourably with the others.

Table V.

	Number Examined.	Standard 3	4	5	6	7	Ex7
Boys.							
Age 12.							
Nose Breathers	69	-	1	14	28	25	1
Mouth Breathers	49	2	5	20	12	10	-
Age 13.							
Nose Breathers	58	-	2	9	16	28	3
Mouth Breathers	39	1	1	13	4	18	2
Girls.							
Age 12.							
Nose Breathers	92	3	6	18	52	10	3
Mouth Breathers	26	3	1	14	7	1	-
Age 13.							
Nose Breathers	52	-	2	8	16	26	-
Mouth Breathers	7	-	-	3	-	4	-

The imformation in this table can be more readily appreciated if the table is condensed as follows:-

Table VI.

	Number Examined.	Below Standard 6.	In Standard 6 and over.
Boys. (ages 12 and 13)			
Nose Breathers	127	20.5%	79.5%
Mouth Breathers	88	47.7%	52.3%
Girls. (ages 12 and 13)			
Nose Breathers	144	25.7%	74.3%
Mouth Breathers	33	63.7%	36.3%

Table VII.

Relative incidence of certain defects.

	Number Examined.	Enlarged Tonsils. Slight.	Enlarged Tonsils. Great.	Enlarged Glands. Slight.	Enlarged Glands. Great.	Otitis. Media.	Deafness.
Boys. (ages 12 and 13)							
Nose Breathers	168	12.5	1.8	19.6	1.8	3.6	4.8
Mouth Breathers	114	9.7	2.6	29.8	.9	11.4	22.8
Girls. (ages 12 and 13)							
Nose Breathers	199	17.3	5.5	22.3	2.5	3.5	8.1
Mouth Breathers	42	21.4	9.5	42.9	4.7	14.3	16.7

For convenience in comparing the two groups the results are given as percentages.

Relation to certain defects.

The last point dealt with in this inquiry was the relative incidence of enlarged tonsils, ear diseases, and enlarged glands. The results are given in table VII. The most striking point is the much greater incidence of ear defects amongst the mouth breathers.

P A R T III.

Conclusions from the facts disclosed.

The two questions to which answers were required were:- What is the actual prevalence of Mouth Breathing? and What is the relationship of Mouth Breathing to Adenoids? We are now in a position to see what answer we can give to these questions.

The first question has been answered in a perfectly definite manner; at least one third of school children breathe through their mouths, and the result of this practice we have also seen.

The second question is a much more difficult one to answer. We are obliged to rely on symptoms in making a diagnosis of adenoids, for the actual

verification of their existance is a procedure which is quite impracticableaas a routine, both in School and in Infant Welfare Work. Let us look at the signs mentioned by Sir George Newman in his Annual Report to the Board of Education for the year 1920:- "Speaking generally, the chief forms of local or constitutional injury brought about by adenoids and which suggest operation are-

a. Ear Complications, Deafness;
b. Hypertrophic rhinitis, mouth breathing, obstructed respiration;
c. Recurring tonsillitis or tonsillar abscess;
d. Deformity of face or chest;
e. Recurrent catarrh, asthma, or septic infection;
f. Retardation of physical or mental growth."

There is nothing peculiar to adenoids in this list of injuries: nothing that nasal catarrh cannot also produce. I would modify Sir George Newman's statement by substituting "nasal catarrh" for the word "adenoids", and by adding another to the list of injuries-

g. Adenoid growth in the naso-pharynx.

I do not think that we shall obtain any reliable answer to our question by any consideration of symptoms, such as are given in Table VII.

Tables I and II, however, contain information which helps us to find an answer. This information, though scanty, points clearly in one direction, and can only be met in one way. I have set this information out graphically in the following charts. Each chart contains two lines; one (black) representing the percentages of mouth breathers, and one (red) representing the percentages of cases of tonsils and adenoids. In each case I have taken the figure for the Entrants as 100, the other figures being in proportion.

Chart I.

Barrow-in-Furness
Boys and Girls.

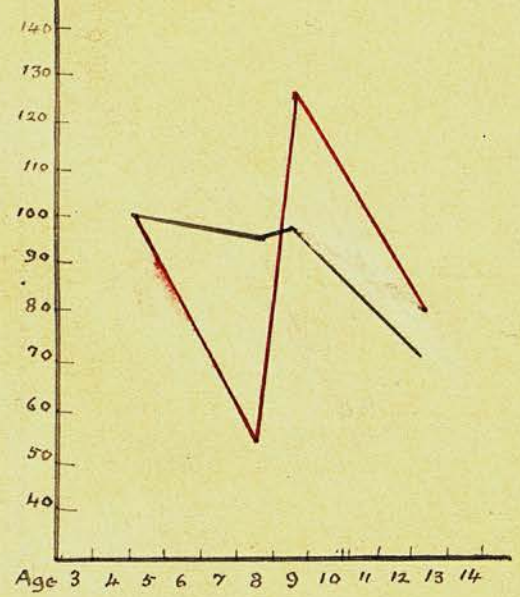


Chart II.

Crewe
Boys and Girls.

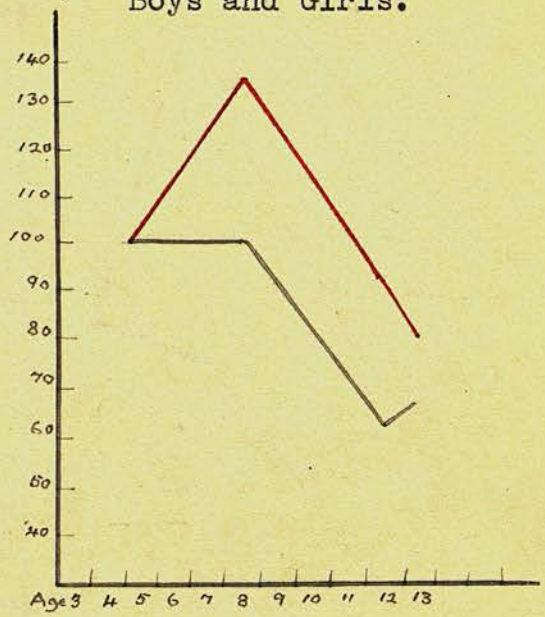


Chart III.

Barrow-in-Furness Boys.

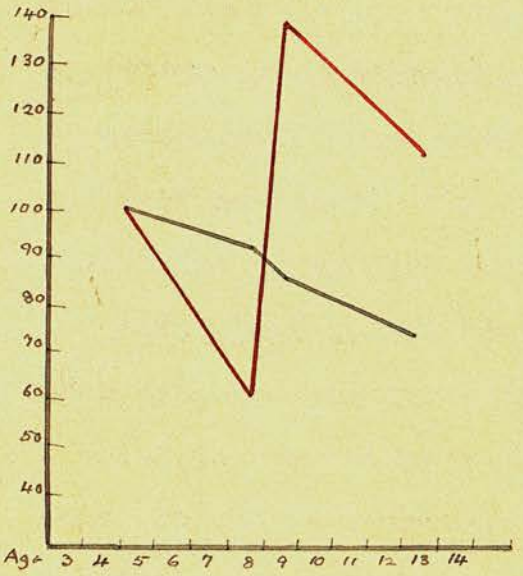


Chart IV.

Barrow-in-Furness Girls.

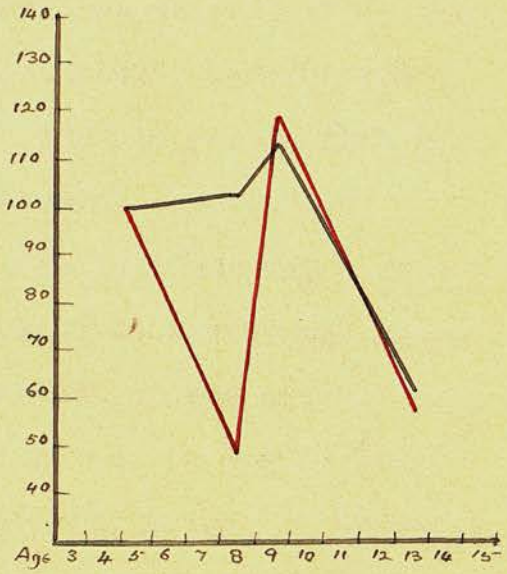


Chart V.

Crewe Boys.

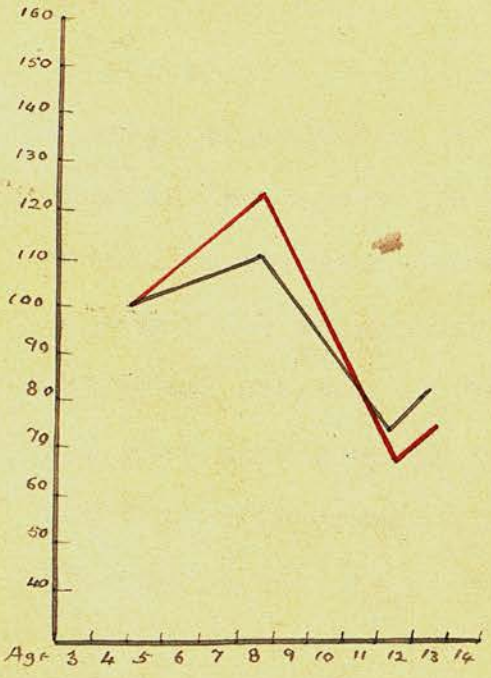
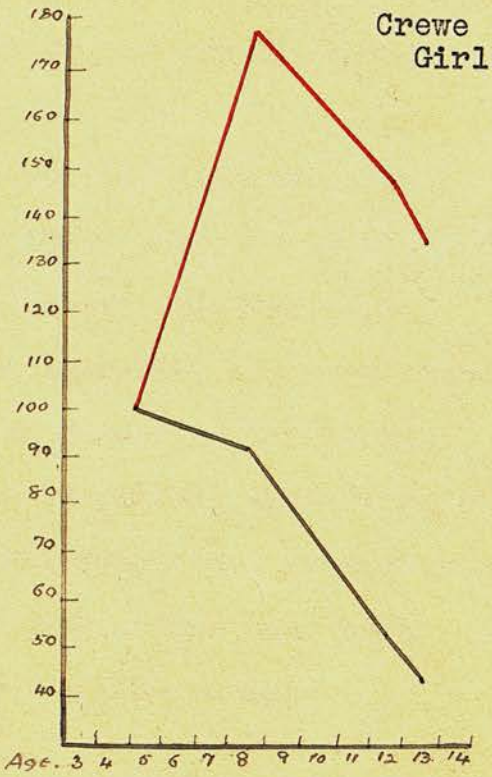


Chart VI.

Crewe Girls.



A study of these charts, which show the variations in the percentages of mouth breathers and of cases of adenoids on the same scale, provides us with three facts.

1. There is apparently no relationship between the percentages of mouth breathers and the percentages of cases of adenoids. The line showing the adenoid percentage is subject to wide fluctuations which have no counterpart in the mouth breathing percentage line. Each line appears quite independent of the other. I think we are entirely justified in concluding from this that mouth breathing is not the result of adenoids.

2. While the percentage of Mouth breathers remains more or less stationary between the Entrants group and the 8 or 9 year old group, the percentage of adenoids tends to increase.

3. In charts I, III, and IV, we find that the percentage of adenoids is low in the 8 year old group, and high in the 9 year old group. These children were attending the same schools and came from the same type of home,but, in the majority of cases, were attending different classes. There can be nothing therefore in the environment or in the social conditions to account for this difference. Similar variations have been frequently noticed in other areas; for example-

The Medical Superintendent of Schools under the Lancashire County Council states in his Annual Report for the year 1914, "Certain schools in rural areas show a striking number of tonsillar and adenoid enlargement for which no adequate reason can be found, adjacent schools being normal."

4. To these we may add a fourth fact which was noted under tables I and II. While girls are less addicted to mouth breathing than are boys of the same ages, yet they are on the whole as subject to enlarged tonsils and adenoids.

There is only one explanation which accounts in a satisfactory manner for each and all of these facts. This is that adenoids are the result of communicable nasal infections.

Applying this explanation to these four facts we see at once that

1. no relationship between the percentage of mouth breathers and the percentage of cases of adenoids need be expected; the number of cases of adenoids in any group of children will vary according to the amount of nasal infection present in that group, and not according to the number of susceptible children, i.e. mouth breathers, who are present.

2. the increase in the percentage of cases of adenoids while the percentage of mouth breathers remains almost stationary is due to an increasing number of clean mouth breathers becoming infected, or is due to the growth of adenoids in infected mouth breathers.
3. as noted under 1. such variations in the prevalence of adenoids are due to the varying amounts of nasal infection present in the various groups. When the amount of nasal infection is great or of high virulence, many cases of adenoids will be found; when little or of low virulence, few.
4. girls, on the whole, are more at home than are boys, and come more into contact with sick inmates, the majority of whose ailments are of a catarrhal nature: they are therefore more exposed to infection. The healthy nasal mucous membrane of the nose breathers overcomes the infection, but the weakened membrane of the mouth breathers succumbs.

Two further considerations lend support to this view. The first is the well known fact that incompletely removed adenoids tend to recur if the practice of mouth breathing is continued. The second is the fact that favourable results have been obtained

in the treatment of mild cases of adenoids by means of nasal hygiene and breathing exercises. It must be obvious that if these two measures have such a great influence in reducing the size of adenoids, their absence must have a prejudicial influence and tend to favour the growth of adenoids.

P A R T IV .

Conclusion.

I ~~xhx~~ have shown that mouth breathing is very prevalent amongst children and that its effects are harmful to the physical and mental progress of the children who practice it. On an average at least one third of the children breathe in this way, and in some groups of children examined the percentage of mouth breathers has been as high as 70%. I am satisfied that in the great majority of cases it is merely a bad habit, one of the results of which is to lead to the growth of adenoids. It is better to prevent adenoids than to remove them when formed, and this can only be done by putting a stop to mouth breathing. As a habit

it can and should be dealt with. This can best be done by making nasal hygiene, in other words,nasal cleanliness, and breathing exercises part of the curriculum of every Infant Department of our schools. It is amongst infants that this habit is most prevalent and there it should be treated. We must go furhher and attack it in the Infant Welfare Centres by impressing on the mothers its evil effects. Only when everyone realizes that this is a serious defect and that its results are serious are we likely to succeed in abolishing it.

It is said that the North American Indians are forbidden on religious grounds to breathe through the mouth, and that adenoids are unknown amongst them. If we will but imitate them in the first respect, the second will become true of us also.

Appendix

Appendix.

Mouth Breathing and Scarlet Fever.

It is interesting to note that while the average percentage of mouth breathers amongst the Crewe school children is 36.8%, the percentage amongst children admitted to the Isolation Hospital suffering from Scarlet Fever is, as a general rule, about 90%. I have found no reason to believe that Scarlet Fever causes even temporary mouth breathing, and I am satisfied that mouth breathing children are much more susceptible to Scarlet Fever than are nose breathing children.

A question which seems to me worthy of further attention is whether the relative prevalence of Scarlet Fever in different towns varies according to the number of mouth breathing children in each town. This question demands for its solution information which at present does not exist, but I can say that so far as the two towns Barrow in Furness and Crewe are concerned, the question can apparently be answered in the affirmative.

II

a. According to the Preliminary Report on the Census, 1921, the population of Barrow was 74,254 persons, and the population of Crewe was 46,477 persons.

Ratio 1. 74,254 : 46,477 :: 100 : 62.6

b. According to the Board of Education Report for the year 1920, the number of school children in Barrow was 10,892, and in Crewe 6,958.

Ratio 2. 10,892 : 6,958 :: 100 : 63.8

c. In Tables I and II we found that the average percentage of mouth breathers amongst the school children was in Barrow 27.6%, and in Crewe 36.8%. Applying these percentages to the total number of school children we find that there are 3,005 mouth breathers in Barrow, and 2,560 in Crewe.

Ratio 3. 3,005 : 2,560 :: 100 ; 80.4

d. From the Reports of the Ministry of Health the numbers of cases of Scarlet Fever in the two towns were:-

	Barrow	Crewe
1920	155	140
1919	136	44
1918	68	61
1917	34	74
Average yearly number	98.25	79.75

Ratio 4. 98.25 : 79.75 :: 100 ; 81.2

The incidence of Scarlet Fever in these two towns during recent years has therefore been in the same ratio as the number of mouth breathers in each town, and not in the ratio of population or of total school children.

It is interesting to find that the age incidence of Scarlet Fever closely corresponds with the age incidence of mouth breathing. Whitlegge and Newman in discussing Scarlet Fever in their book on Hygiene and Public Health state "Children under 1 year of age, and especially under 3 months, are comparatively rarely attacked, but the incidence rapidly increases and reaches its maximum in the fifth year of life. After that period it declines steadily year by year. About 45 per cent. of the attacks occur at ages under 5 years, 40 per cent. between 5 and 10 years, and 11 per cent. between 10 and 15 years." If these figures are compared with the percentages of mouth breathers in Tables I and II it will at once be seen how similar the incidences of these two conditions are.

It may well be that the failure of Scarlet Fever